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(54) Self-supporting carcass for motor-vehicle tyres.

(57) Inserted in the carcass (1) of a tyre (2), at each sidewall (5) thereof, are a first and a second elastomeric reinforcement inserts (13, 15) interposed between a first and a second carcass ply (10, 11) and each growing thinner towards the respective opposite ends of its own section. The reinforcement inserts (13, 15) are joined together in alignment with the maximum-chord point (14) of the tyre (2). A third elastomeric insert (16) of lenticular section, internally covers the first carcass ply (10) and exhibits an area of maximum thickness (16a) in alignment with the junction area (14) between the reinforcement inserts (13, 15). The reinforcement inserts (13, 15) behave like stiff arms, mutually hinged at the junction point (14) thereof, the moving close to each other of said arms being counteracted by a third elastomeric insert (16) behaving like a spring.

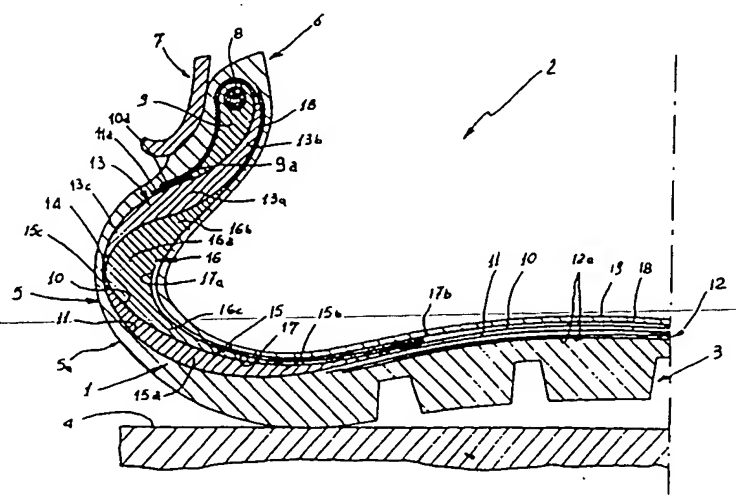

FIG. 2

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The present invention relates to a self-supporting carcass for motor-vehicle tyres, of the type comprising: a pair of circumferentially inextensible anchoring rings or bead cores, each inserted in a bead defined along an inner circumferential edge of a tyre; a pair of elastomeric fillings each of which extends along an outer circumferential edge of one of the anchoring rings and tapers radially away from the tyre axis; one carcass ply and a second carcass ply superposed to the first ply in a radially outer position, at least one of said carcass plies having its edges folded back around the anchoring rings and the elastomeric fillings; a tread band disposed crown-wise to said carcass and a circumferentially inextensible belt structure extending as a ring, interposed between the carcass plies and the tread band and at least a pair of annular reinforcement inserts made of elastomeric material of lenticular section, each of which is interposed between the first and second carcass plies, at a tyre sidewall, and extends radially between one of the beads and the corresponding end of the belt structure.

The carcass in accordance with the invention is of the type used when a tyre is wished to be given the capability of covering considerable distances at fair speed even in the case of complete deflation, for example as a result of a puncture.

It is known that there are different types of tyres commonly referred to as "self-supporting tyres" which have the quality of enabling the motor-vehicle to go on running at fair speed even when the tyre has been accidentally deflated.

Between the different solutions suggested for the achievement of this particular feature, particularly advantageous has proved to be the adoption of carcass structures having reinforced sidewalls so that they can elastically withstand the load weighing on the wheel when the sustaining action normally exerted by the air contained in the tyre goes out. This solution has aroused great interest in the field, as it appears potentially capable of offering the self-support quality without impairing other characteristic performances of the tyre too much, such as for example the direction steadiness, road-holding, side steadiness when bending and drifting and, also important, comfort during the ride.

It is apparent that this type of carcass, in order to be able to work in both situations, needs to be mounted on a rim of the type provided with suitable protuberances, commonly referred to as humps, ensuring the tyre beads to be held within their housings even in a situation of complete deflation.

The foregoing being stated, it is noted that the present carcasses for self-supporting tyres having reinforced sidewalls can be substantially classified in two different types.

One carcass type, for example described in US Patent No. 4,193,437, features that at least an annular insert of elastomeric material and lenticular section is inserted in each of the tyre sidewalls, said insert being applied to a position axially internal to the carcass ply or plies. This insert has the task of elastically supporting the load weighing on the wheel in case of deflation, due to its resistance to crushing/bending.

It is however to be pointed out that in order to give an appropriate self-support capability to the above mentioned inserts, they need to have important sizes and a great hardness, which results in the development of high heat amounts in the carcass both when the ride takes place in a deflated condition and when the tyres are inflated to a normal pressure. Since heat thus produced is of difficult removal, it brings about undesired overheating and, as a result, a quick decay of the strength features in the tyre structure.

In addition, the high stiffness necessarily given to the reinforcing insert greatly impairs the ride comfort.

In the attempt of solving these problems a second type of self-supporting carcass has been devised, such as for example that disclosed in British Patent No. 2,087,805, in which it is provided that at least one of the reinforcing inserts disposed in each of the sidewalls be interposed between two of the carcass plies. While this solution has led to important improvements as compared with those previously described, it still has some problems limiting its field of application.

Firstly, it has been found that during the ride both under conditions of normal-pressure inflation and under conditions of even partial deflation, the ply or plies disposed in the innermost regions of the tyre are submitted to anomalous compressive stresses due to the vertical loads and drift thrusts weighing on the tyre itself. These stresses and the resulting localized overheating easily lead to an early yielding of the tyre structure. In addition the insertion of an elastomeric reinforcement piece between the plies, in the region of maximum chord and bending of the tyre has been found to greatly condition the stiffness value of the tyre sidewall, which adversely affects the comfort during the ride.

The main object of the present invention is substantially to solve the problems of the known art, by providing a self-supporting carcass capable of minimising the likelihood that the carcass plies in an axially internal position may work in compression under any use condition, that is when the tyre is properly inflated and when it is deflated, while at the same time moving the plies away from the area in which the maximum heat generation occurs, which will bring about important advantages as regards the thermal level reached and therefore the

maintenance of adhesion between the ply cords and the embodying compound.

Another object of the invention is to provide a carcass imparting optimal flexibility features to the tyre sidewalls for the purpose of achieving excellent comfort under any ride condition.

The foregoing and further objects that will become more apparent in the course of the present description, are substantially attained by a motor-vehicle tyre having a self-supporting carcass, characterized in that for each tyre sidewall it comprises:

- one annular reinforcement insert interposed between the first and second carcass plies, exhibiting an area of maximum thickness disposed substantially in alignment with the outer circumferential edge of the corresponding filling, and from which area two portions depart, one being radially internal, extending alongside the filling and tapering substantially in alignment with the bead core and the other being radially external and extending away from the filling while growing thinner as it goes closer to a point of maximum chord in the tyre;
- a second annular reinforcement insert interposed between the first and second carcass plies and exhibiting an area of maximum thickness disposed at the junction area between the tyre sidewall and tread band and from which two portions depart, one being radially external, extending substantially in a direction parallel to the tyre axis and tapering under a corresponding edge of said belt structure, and the other being radially internal and growing thinner towards the radially external portion of the first annular reinforcement insert, joining the latter close to the point of maximum chord in the tyre;
- a third annular insert of elastomeric material internally lining the first carcass ply and exhibiting an area of maximum thickness disposed substantially in alignment with the junction point between the annular reinforcement inserts, and from which two portions depart, one being radially internal and substantially tapering in alignment with the area of maximum thickness of the first reinforcement insert and the other being radially external and substantially tapering in alignment with the area of maximum thickness of the second reinforcement insert.

Further features and advantages will be best understood from the detailed description of a preferred embodiment of a self-supporting carcass for motor-vehicle tyres in accordance with the present invention, given hereinafter by way of non-limiting example with reference to the accompanying drawings, in which:

Fig. 1 is a diametrical half section, interrupted at the axial centre line, of a tyre having a self-supporting carcass in accordance with the present invention, running at a normal inflation pressure;

Fig. 2 is a half section similar to that in Fig. 1, showing the tyre running under deflation conditions;

Fig. 3 is a diagram showing variations in temperature and radial deformation depending upon the kilometric distance covered to a constant speed, in tyres manufactured following two different embodiments of the invention.

Referring particularly to Figs. 1 and 2, the structural part constituting the foundation of motor-vehicle tyres usually referred to as carcass, of the self-supporting type in accordance with the present invention, has been generally identified by reference numeral 1.

The carcass 1 is conventionally associated with a tyre 2. Defined in the tyre, as is known, is a tread band 3 disposed crown-wise to the carcass, shaped as a ring and arranged to act by contact on the road surface (4), as well as two sidewalls 5 extending in a substantially radial manner from the opposite edges of the tread band 3, and two beads 6 defined along the circumferential inner edges of the tyre 2, at which beads the engagement of the tyre by a rim 7 carried by the motor-vehicle on which the tyre is mounted takes place.

In the accompanying drawings only one of said sidewalls 5 and one of said beads 6 is shown.

The carcass 1 conventionally provides the presence of a pair of anchoring rings 8, commonly referred to as "bead cores", each inserted in one of the beads 6. The bead cores 8 are circumferentially inextensible and offer the necessary stiffness to the bead 6 so as to enable the proper assembling of the tyre to the rim 7.

Extending along the circumferential outer edge of each of the bead cores 8 is an elastomeric filling 9, tapering radially away from the tyre axis.

Still in known manner, a first carcass ply 10 and a second carcass ply 11 overlapping the first ply 10 at a radially external position are provided to extend over the whole section of the tyre 2. At least one of the carcass plies 10, 11 has its edges 10a, 11a, folded back around the bead cores 8 and the elastomeric fillings 9.

Tyre 2 also comprises a belt structure 12 which is circumferentially inextensible and is comprised of one or more radially superposed plies 12a, extending as a ring interposed between the carcass 1 and the tread band 3.

In the accompanying figures, for the sake of clarity, the thicknesses of the plies 10, 11, 12a are shown in solid blackened lines spaced apart from

one another. Actually, the plies are superposed in mutual contact relationship, except in the region of the sidewalls 5, as better clarified in the following.

In an original manner, in accordance with the present invention, the carcass 1 further comprises, for each of the tyre sidewalls 5, a first annular reinforcement insert 13 interposed between the first and second carcass plies 10, 11, and exhibiting an area of maximum thickness 13a disposed substantially in alignment with the circumferential outer edge 9a of the corresponding filling 9. Departing from the area of maximum thickness 13a, is a radially internal portion 13b extending alongside the filling 9 and tapering substantially in alignment with the bead core 8, as well as a radially external portion 13c extending away from the filling 9 and growing thinner as it goes closer to the point of maximum chord in the tyre 2. By point of maximum chord it is meant the area in which the tyre 2 exhibits its maximum width, as measured parallelly to its axis. The carcass 1 in accordance with the present invention also comprises a second annular reinforcement insert 15, interposed between the first and second carcass plies 10, 11 as well, at a radially external position relative to the first reinforcement insert 13. In greater detail, the second reinforcement insert 15 exhibits an area of maximum thickness 15a disposed at a connecting region, commonly referred to as "buttress" and denoted by 5a, between the sidewall 5 and the tread band 3. Departing from the maximum thickness area 15a is a radially external portion 15b extending in a direction substantially parallel to the tyre axis and tapering under a corresponding edge of the belt structure 12, as well as a radially internal portion 15c growing thinner towards the radially external portion 13c of the first annular reinforcement insert 13 and joining the latter at a junction point 14 substantially coincident with said maximum chord point.

It is to be noted that the two reinforcement inserts 13 and 15 must not be necessarily joined together at the junction point 14 neither must they be made of the same elastomeric material; they can be two distinct inserts as regards their elastomeric composition and/or they can be physically separated at the junction point 14 by a third element interposed therebetween, as hereinafter explained.

In fact, in an original manner, the presence of a third annular insert 16 of elastomeric material is also provided; it covers the first carcass ply 10 at a position radially internal to the tyre 2. The third annular insert 16 exhibits a respective area of maximum thickness 16a substantially disposed in alignment with the junction point 14 between the annular reinforcement inserts 13 and 15. Departing from this area 16a is a radially internal portion 16b tapering substantially in alignment with the area of maximum thickness 13a of the first reinforcement insert 13 and a radially external portion 16c substantially tapering in alignment with the area of maximum thickness 15a of the second reinforcement insert 15.

The size features of the three inserts 13, 15, 16 can vary depending upon the type of motor-vehicle for which the tyre is designed, as well as the operating features to be given to the tyre itself.

On the whole, the thickness of inserts 13, 15, 16 is reduced when the tyre 2 is intended for light-in-weight cars and/or in order to favour the carcass resistance to high speeds with respect to the life-time under ride conditions with a flat tyre. By way of example, when the tyre 2 is intended for use on normal cars, the thickness of the first insert 13 should conveniently be comprised between 2.5 mm and 7 mm, at the area of its maximum thickness 13a, while the thickness of the second insert 15, still referring to its area of maximum thickness 15a, should be in the range of 2.5 mm to 5 mm. The third insert 16, in turn, should preferably have a thickness included between 5 mm and 15 mm at the area 16a.

The thickness of the first and second inserts 13, 15 at the mutual junction area 14 should preferably be less than 3.5 mm.

As regards the elastomeric material of said inserts, it conveniently consists of compounds having a high stiffness and a low hysteresis which are known per se and in particular adapted for this type of use.

A very important function associated with the three inserts 13, 15 and 16 and their sizes, consists in conditioning the development of the ply profile on the right section of the tyre, as better clarified in the following.

Preferably, associated with the third insert 16 is at least a textile reinforcement strip 17, for example made of nylon or aramide, applied at an axially internal position to the radially external portion 16c of the third insert itself. The textile reinforcement strip 17 has a first end edge 17a terminating at a radially internal position relative to the junction point 14, between the first reinforcement insert 13 and the second reinforcement insert 15, as well as a second end edge 17b terminating beyond the end-of-the-radially-external-portion 16c of the third insert 16.

In accordance with a further preferential feature of the invention, the whole inner surface of the carcass 1 can be covered with a layer of halobutyl-based elastomeric material 19 highly impervious to air, consisting for example of chlorobutyl or bromobutyl which, at least in the circumferential area substantially extending astride of the junction point 14 between the first and second reinforce-

ment inserts 13, 15, is replaced by a compound having a high polybutadiene content (at least 30% of parts by weight for 100 parts of compound), to which paraffin is optionally added. In this way an optimal adhesion of the lining layer 19 to the third insert 16, or in case, to the reinforcement strip 17 is ensured, also under ride conditions with a flat tyre, together with a high resistance to abrasion and, as a result of the presence of paraffin, a reduction of possible rubbing frictions.

The operating behaviour of the carcass in accordance with the present invention is as follows.

First of all it is to be noted that advantageously and in an original manner, the first and second inserts 13, 15 enclosed between the first and second carcass plies 10, 11, substantially behave like two rigid arms mutually hinged at their junction point 14. The third insert 16, in turn, substantially behaves like a spring counteracting the tendency of the first and second inserts 13, 15 to move close to each other due to the load weighing on the motor-vehicle wheel.

Referring to Fig. 1, under conditions of normal use of the tyre 2, when the load weighing on the wheel is almost completely counteracted by the pressure of air contained in the tyre itself, the third annular insert 16 is only slightly stressed to compression, so that the tyre sidewall 5 lends itself to be deformed in the best manner for absorbing impacts and stresses resulting from the presence of asperities on the road surface (4). In other words, the stiffness to crushing of the tyre, under this situation and as regards comfort, is substantially identical to that of the best tyres having a traditional carcass structure. This is the best operating condition as regards comfort during the ride.

When, on the contrary, due to an accidental puncture, a partial or total deflation of the tyre 2 occurs, the stiffness to crushing of the tyre of the invention is about twice that of the traditional tyres. In this case (Fig. 2), the load weighing on the motor-vehicle wheel is mostly counteracted by the spring reaction supplied by the third insert 16 as a result of its being stressed to compression, said stress being mainly concentrated on the area of maximum thickness 16a. In greater detail, it is to be advantageously noted that, as a result of said stress, the elastomeric material forming the third insert 16 tends to move axially towards the outside of the tyre 2, exerting an important thrust force on the first and second carcass plies 10, 11, at the junction point 14 between the first and second inserts 13, 15. Under this situation, one can be sure that the carcass plies 10, 11, are submitted to tractive stresses on the inner extension of their sectional profile.

Advantageously, on tensioning the carcass plies 10, 11, a spring reaction by the first and second reinforcement inserts 13, 15 takes place, said inserts behaving like counter-deflected leaf-spring arms.

As a result, the inner ply or plies, by effect of the counter-deflection have tendency to get stretched thereby helping in reducing the likelihood of crushing at the most critical point 14 already supported by the filling 16 and facilitated by the minimization of its distance from the outer ply, that is the ply that mainly controls the local position of the neutral axis under crushing.

Still in order to facilitate the tension distribution between the two plies as much as possible under any use condition, it is to be noted that the lunette 15 shapes the inner ply according to the development of the equilibrium profile, while on the contrary the outer ply is deformed locally off-profile with a tendency to discarge most ot the carcass tension onto the inner ply by free inflation.

As a result, both in normal use and during the ride with a flat tyre, when the sidewalls are bent, the outer ply has a natural tendency to increase its contribution to the carcass tensioning, to the detriment of the inner ply; however since the latter has been originally preloaded, the possibility of being crushed is greatly reduced.

Therefore, by means of the carcass of the present invention a sharp improvement in the structural resistance of the tyre is achieved under ride conditions both with a flat tyre and with a normal tyre, without the self-supporting feature impairing the ride comfort.

Different practical tests, carried out by the same applicant, have proved the validity of the solutions suggested by the present invention.
In particular, a tyre having a carcass in accordance with the invention, devoid of the reinforcement strips 17, has been submitted to a fatigue test under deflation conditions, and compared with tyres of the same size made in accordance with the known art, the test conditions being the same. In greater detail, the fatigue test consisted in making the tyres under examination run under a completely deflated condition and charged with the exercise load, against a wheel acting as road, at a constant speed and with a controlled drift thrust; as regards the control tyres, one type of tyre in accordance with the known art had a carcass provided with two plies between which, at each of the sidewalls, a single elastomeric insert of lenticular section was interposed. A second type of known tyre submitted to test was provided with a carcass having two elastomeric inserts of lenticular section in the sidewalls, one of them interposed between the carcass plies, whereas the other was applied to the inner carcass ply.

The same weight has been imposed to the

carcasses as an equivalence criterion.

In said ride test under deflation conditions, the tyres made in accordance with the invention have substantially shown the same duration (distance covered) as that of the first type of known tyre. The duration of the second type of known tyre, on the contrary, as been equal to about one third of the duration of the tyre in accordance with the invention.

Fatigue tests have been then carried out on the same types of tyres with a 70% overload with respect to the rated load and to a normal inflation pressure.

In these tests, the tyre of the invention has exhibited a lifetime more than 20% longer than the second type of known tyre. On the contrary, the duration of the first type of known tyre has been less than one third as compared with that of the tyre of the present invention.

Shown in the graph of Fig. 3 are the variations in temperature and crushing depending upon the kilometric distance covered, which have been detected by submitting two different embodiments of the tyre in accordance with the invention to the above mentioned fatigue test under deflated conditions, at a constant speed of 60 km/hour. These embodiments are different from each other only due to the presence of the textile reinforcement strips 17 in the sidewalls 5.

The curves identified by δ' and T' respectively represent the development of the radial crushings and temperatures exhibited by the tyre having a carcass provided with the textile reinforcement strip 17, depending upon the distance covered. On the contrary, the curves identified by δ'' and T'' represent the development of the crushings and temperatures in a tyre devoid of the textile reinforcement strip 17. As can be easily viewed from Fig. 3, the tyre provided with the reinforcement strips 17 has shown a lower increase in temperature as well as a lower crushing, which is an evidence of a more reduced fatigue of the carcass. It is rather to be pointed out that the embodiment having the reinforcement strip 17 tends to keep the reached asymptotic temperature and crushing conditions, whereas the embodiment devoid of the strip 17, after about 100 kilometers, shows a tendency to a progressive increase in the parametric decay value. Therefore the duration until breakage of the tyre provided with the textile reinforcement strips 17 has been 50% higher than the embodiment in which said strips are not present.

The achievement of this important result is due to the fact that the textile strip 17 accomplishes the function of a barrier to the wear progress on the covering intrados, which reduces the negative effects produced by rubbing in the critical area of maximum compression.

The present invention attains the intended purposes.

As is clear from the foregoing, the carcass in question offers an important improvement in the distribution of stresses in the tyre structure, which brings about a great reduction in the loss of energy due to heat, and therefore a sharp improvement in the tyre lifetime as compared with the tyres of the known art, both with reference to the ride in a condition of normal inflation pressure, and with reference to the ride with a flat tyre.

In addition, the carcass structure in accordance with the invention, while giving the tyre the self-support feature, does not prevent the side deformability of the same, which is indispensable to the ends of comfort during the ride.

Obviously modifications and variations can be made to the invention as conceived, all of them falling within the scope of the inventive idea.

Claims

1. A motor-vehicle tyre having a self-supporting carcass, exhibiting a circumferential crown portion connected to two sidewalls radially extended towards the inside and terminating in beads for assembling the tyre to a corresponding mounting rim, comprising:
   - a pair of circumferentially inextensible anchoring rings or bead cores (8), each inserted in a bead (6) defined along an inner circumferential edge of a tyre (2);
   - a pair of elastomeric fillings (9) each of which extends along a circumferential outer edge of one of the anchoring rings (8) and tapers radially away from the tyre axis;
   - one carcass ply (10) and a second carcass ply (11) superposed to the first ply (10) in a radially outer position relative thereto, at least one of said carcass plies (10, 11) having its edges folded back around the anchoring rings (8) and the elastomeric fillings (9);
   - a tread band (3) disposed crown-wise to said carcass; - a circumferentially inextensible belt structure (12), extending as a ring and interposed between the carcass (1) and the tread band (3); and
   - at least a pair of annular reinforcement inserts made of elastomeric material and of lenticular section, each of which is interposed between the first and second carcass plies (10, 11), at one tyre sidewall (5), and extends radially between one of the beads (6) and the corresponding edge of the belt structure (12), characterized in that for each tyre

sidewall (5) it comprises:

- one annular reinforcement insert (13) interposed between the first and second carcass plies (10, 11), exhibiting an area of maximum thickness (13a) disposed substantially in alignment with the outer circumferential edge (9a) of the corresponding filling (9), and from which area two portions (13b, 13c) depart, one (13b) being radially internal, extending alongside the filling (9) and tapering substantially in alignment with the bead core (8) and the other (13c) being radially external and extending away from the filling (9) while growing thinner as it goes closer to a point of maximum chord (14) in the tyre (2);
- a second annular reinforcement insert (15) interposed between the first and second carcass plies (10, 11) and exhibiting an area of maximum thickness (15a) disposed at the junction area (5a) between the tyre sidewall (5) and tread band (3) and from which two portions (15b, 15c) depart, one (15b) being radially external, extending substantially in a direction parallel to the tyre axis and tapering under a corresponding edge of said belt structure (12), and the other (15c) being radially internal and growing thinner towards the radially external portion (13c) of the first annular reinforcement insert (13), joining the latter close to the maximum chord point of the tyre (2);
- a third annular insert (16) of elastomeric material internally lining the first carcass ply (10) and exhibiting an area of maximun thickness (16a) disposed substantially in alignment with the junction point (14) between the annular reinforcement inserts (13, 15), and from which two portions (16b, 16c) depart, one (16b) being radially internal and substantially tapering in alignment with the area of maximum thickness (13a) of the first reinforcement insert (13) and the other (16c) being radially external and substantially tapering in alignment with the area of maximum thickness (15a) of the second reinforcement insert (15).

2. A tyre according to claim 1, characterized in that for each sidewall (5) it further comprises at least a textile reinforcement strip (17) applied at an axially internal position to the third annular insert (16) and exhibiting one end edge (17a) terminating at a radially internal position relative to the junction point (14) between the first and second reinforcement inserts (13, 15) and a second end edge (17b) terminating past the end of the radially external portion (16c) of the third annular insert (16).

3. A tyre according to claim 1, characterized in that said annular inserts (13, 15, 16) impose an equilibrium configuration to the axially internal carcass ply (10) on the right section thereof.

4. A tyre according to claim 1, characterized in that it is internally lined with a layer of a halobutyl-based elastomeric material (19) which at least at the circunferential area astride of the junction point (14) between the first and second reinforcement inserts (13, 15) is replaced by a compound having a high polybutadiene content.

5. A tyre according to claim 4, characterized in that said polybutadiene content is not less than 30% of parts by weight for 100 parts of compound.

6. A tyre according to claim 4, characterized in that said compound having a high polybutadiene content contains paraffin.

7. A tyre according to claim 1, characterized in that the thickness of the first reinforcement insert (13) at said area of maximum thickness (13a) is included between 2.5 mm and 7 mm.

8. A tyre according to claim 1, characterized in that the thickness of the second reinforcement insert (15) at the area of maximum thickness (15a) is in the range of 2.5 mm to 5 mm.

9. A tyre according to claim 1, characterized in that the thickness of the first and second reinforcement inserts (13, 15) at the mutual junction point (14) is lower than 3.5 mm.

10. A tyre according to claim 1, characterized in that the thickness of the third annular insert (16) at the area of maximum thickness thereof (16a) is in the range of 5 mm to 15 mm.

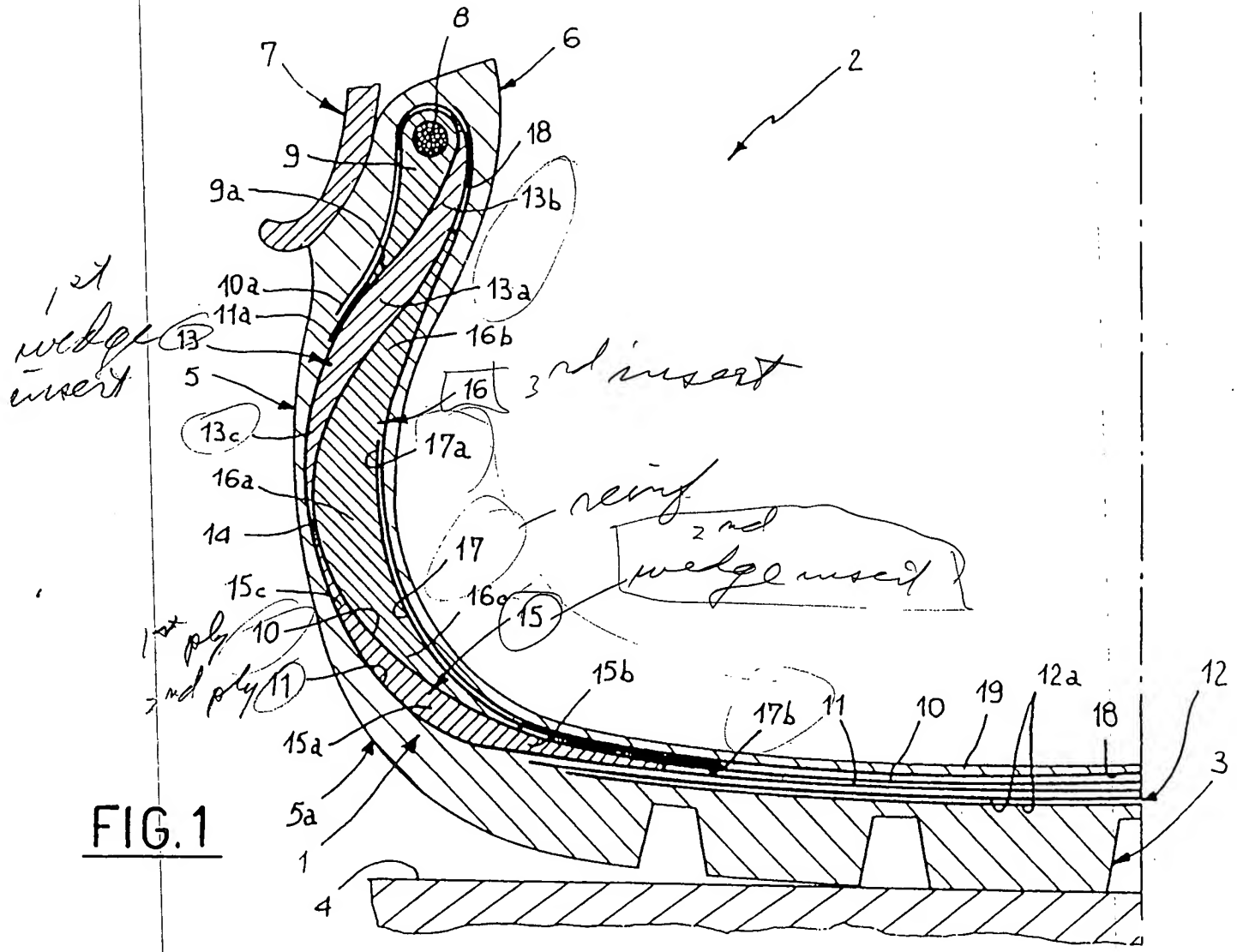
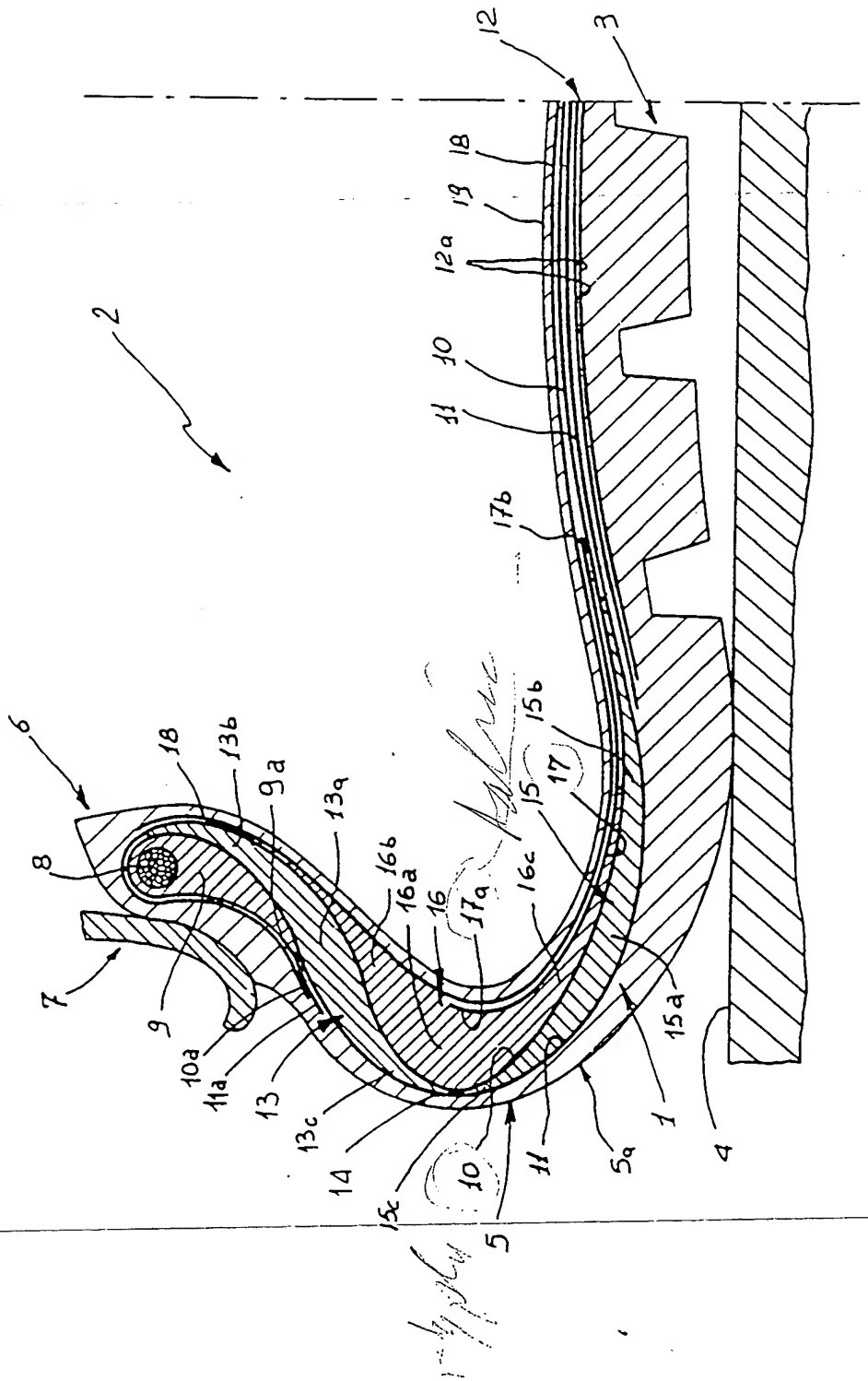


FIG.1

- location is diff
- Ratio ?


12
3
18
13
12a
10
11
2
17b
6
18
13b
9a
13a
8
16b
16a
16
17a
15
17
15b
16c
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11
5
5a
1
15a
4

FIG. 2

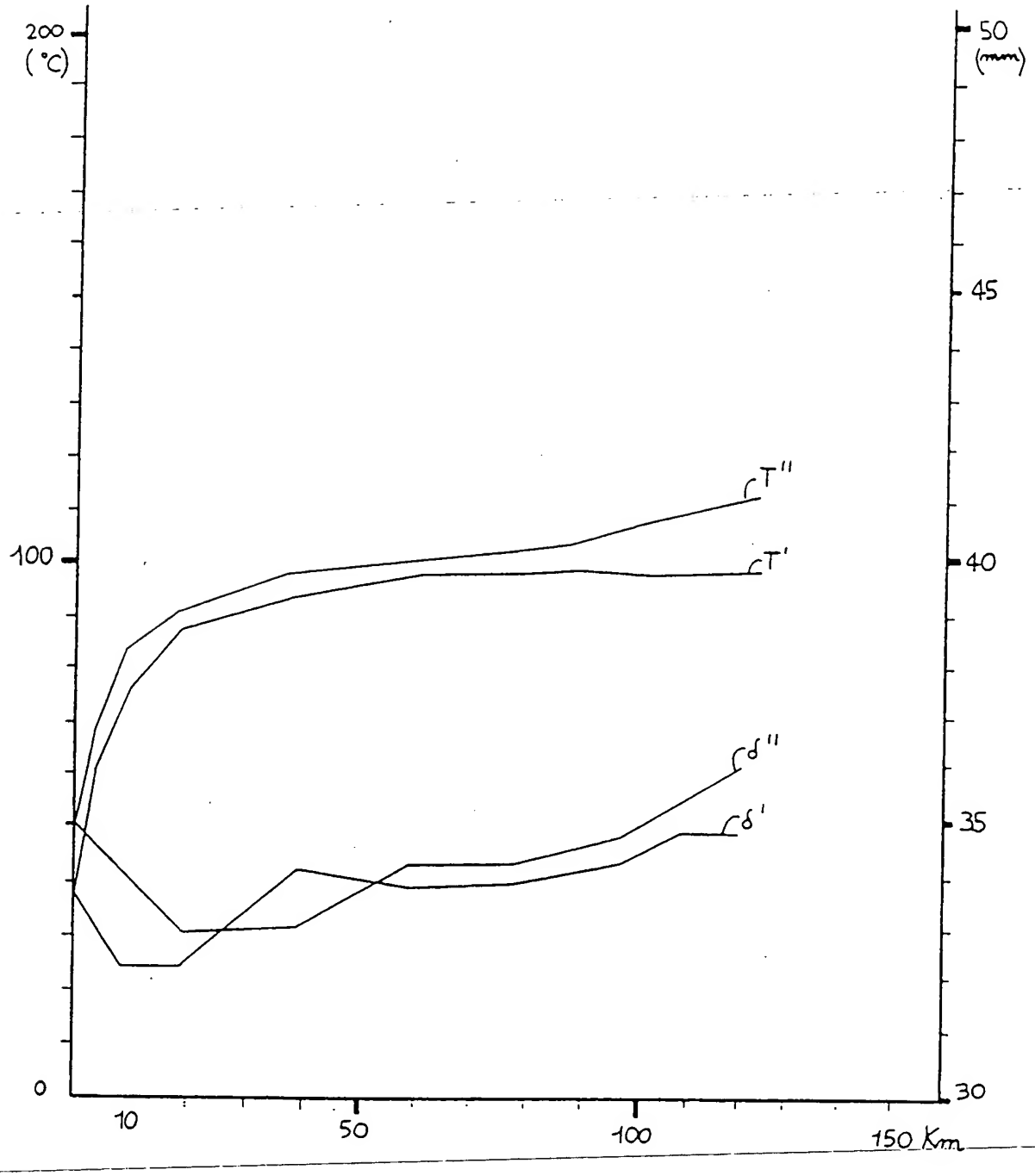

FIG. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 11 4893

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	US-A-3 292 681 (G.L. TRAVERS) * Column 3, line 5 - column 4, line 69; column 5, line 21 - column 7, line 43 *	1	B 60 C 17/00 B 60 C 9/14
Y,D	GB-A-2 087 805 (GOODYEAR) * Page 1, line 102 - page 2, line 82; figure 1 *	1	
A	LU-A-62 689 (MICHELIN)		
A	DE-A-2 331 530 (BRIDGESTONE)		
A	US-A-4 779 658 (M. KAWABATA)		
A	FR-A-1 296 073 (MICHELIN)		
A	FR-A-2 137 339 (MICHELIN)		
A	EP-A-0 385 192 (PIRELLI) * Page 9, claim 6 *	2	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
B 60 C

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	08 October 91	SCHMITT L.P.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same catagory
A : technological background
O : non-written disclosure
P : intermediate document
T : theory or principle underlying the invention

E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document